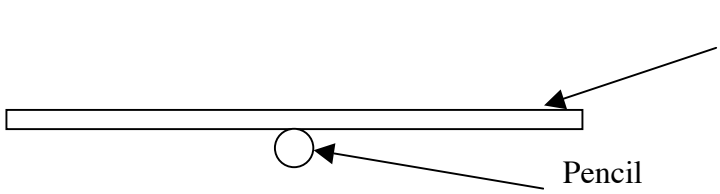
LEVER LAB

Materials: Ruler (12-inch) Pennies Pencil

Instructions:

Set up your lever as shown:



1. The smaller end of the ruler (the one-cm end) will be for the load or the resistance force.
2. The larger end of the ruler (the 30-cm end) will be for the effort force.
3. Put the fulcrum in the middle of the lever at the 6" mark.
4. Put a load of one penny at the end of the LOAD END of the lever. Put the load as close as possible to the end of the lever. Be careful that the fulcrum stays in place.
5. Apply a force by putting pennies at the FORCE END of the lever. Keep them as close as possible to the end and be careful that the fulcrum stays in place. Add just enough pennies to lift the load.
6. Record the number of pennies you need to lift the load. (I've done this one as an example in the table below).
7. Leaving the single penny at the LOAD END of the lever, find 3 other placements of pennies that will lift (or just balance) the load.

Fulcrum At (Inches)	Resistance Load at End of Ruler (# of pennies)	Effort Force Needed (# of pennies to balance)	Effort Force Distance (cm) (from fulcrum to force load)
6	1	1	15
6	1		
6	1		
6	1		

Try these other fulcrum placements and find several effort placements that will work.

5	1		
5	1		
5	1		
5	1		
4	1		
4	1		
4	1		
4	1		

Calculating Work and Mechanical Advantage

Figure out the force (weight) of one penny and complete the table below that will show the mechanical advantage of this kind of lever. (Weight = mass (kg) x acceleration due to gravity)

Mass of One Penny in kg: _____ Weight of One Penny in Newtons: _____

Resistance Force (weight of one penny in Newtons)	**Effort Force (N) (weight of # of pennies required to balance)**	**Mechanical Advantage (calculated using forces: Resistance Force divided by Effort Force)**	**Distance effort (distance in meters from fulcrum to your stack of pennies)**	**Distance Resistance (distance in meters from single load penny to fulcrum)**	**Mechanical Advantage (calculated using distances: Effort distance divided by Resistance distance)**

Questions:

1. Compare the effort distance (D_E) and the effort force (F_E) in all trials. What happens to the amount of F_E as the D_E increases?

2. Use the term "inverse" or "direct" to explain the relationship between F_E and D_E as you adjusted your lever.

3. What class of lever did this represent?

4. What conclusions can you draw from comparing the MA using the forces and MA using the distances for each trial.

5. As the effort distance increases, what happens to the MA for each trial?